# Navy Recruiter Selection Study

CNA MPT Conference

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# Background

- Some recruiters have higher productivity than others.
- Differences in productivity may be systematically related to recruiter characteristics that can be used to choose recruiters.
- If recruiters can be selected based on characteristics that are related to productivity,
  - average productivity of the recruiting force increases, and,
  - the same recruiting goals can be met with fewer recruiters and at lower cost.

# Purpose of Project

## Phase I

- Estimate preliminary selection equations to predict Navy recruiters' performance using currently available data on:
  - demographics (e.g., rank, military experience)
  - ASVAB test scores
  - recruiter training school grades, and
  - characteristics of the recruiting station in which a recruiter works.
- Develop a cost-effectiveness model to estimate:
  - benefits of using currently available data
  - potential benefits of improved selection methods

## Phase II

- Will analyze whether personality measures can improve prediction of Navy recruiters' performance beyond what currently available measures predict.

# Equations to Predict Productivity: Validity Analyses

- Two measures of recruiter productivity as criterion variables:
  - Total recruits
  - High-quality recruits
- Control variables:
  - Recruiting station characteristics (control for demographic and economic variations in recruiter locations)
  - Experience as a recruiter
  - Seasonality
- Potential selection variables:
  - Recruiter characteristics (e.g., education, rank, years of service)
  - ASVAB scores
  - Recruiter training school grades

# Variations in Recruiting Stations & Periods

- Individual recruiter productivity can vary due to differences in:
  - Demographic and economic conditions at recruiting stations
  - Time periods when a recruiter is working

- We found considerable variation across stations and recruiting periods. Means were as follows:
  - 4,334 males aged 17-21 per area (standard deviation (sd) 2,050)
  - 1,466 high school seniors (sd 730)
  - 439 seniors tested on ASVAB 1991-94 (sd 392)
  - 179 tested on ASVAB with Upper Mental Grade (sd 156)
  - 371 days at a recruiting station (sd 140 days)
  - 4 full quarters as recruiter (range from 1 to 7, FY99 Q1 to FY00 Q3)

# Characteristics of Recruiters in Analysis

- Database on 1,179 recruiters in period Qtr 1 FY99 thru Qtr 3 FY00
  - 94% male
  - 64% White, 22% African American, 9% Hispanic, 5% Other
  - 76% married
  - 99% with high school diploma
  - 62% have diploma and AFQT above 50th percentile
  - Ranks: E-4 (5%),E-5 (49%), E-6 (36%), E-7 (11%)
  - Mean active military service of 135 months (range from 30 to 300 months)

# ASVAB Scores & Recruiter Training Grades

- ASVAB Scores
  - Mean AFQT is 57.6 (sd 22.5)
  - Mean ASVAB test scores range from 52 to 55 (sds range from 6 to 9, lowest minimum 22, highest maximum 80)

- Mean Recruiter Training School Grades
  - Module 2 = 90.6 (sd 6.1)
  - Module 3 = 90.7 (sd 6.3)
  - Module 4 = 87.7 (sd 5.7)
  - Composite of all grades = 89.7 (sd 4.8)

- Low variance of test scores and grades reduces likelihood they will be significant predictors of productivity.

# Productivity of Recruiters in Analysis

- Total and high-quality recruits of a recruiter are the two measures of productivity.
  - Average number of recruits per recruiter: 17.1
  - Average number of high-quality recruits per recruiter: 9.2

- This is during an average recruiting time period of about 1 year:
  - Active as recruiter for 4 full quarters of a year, or 371 days, on average (as of the end date for the database collected)

- Because recruiters were active for different lengths of time in this database (1-7 quarters, up to 639 days), regression equations and model calculations were based on recruits per quarter.

# Results: Training Grades as Criteria

- Least Squares (OLS) regression analysis is normally used to analyze the validity of selection methods
- Before analyses with productivity as criteria, we used OLS regression to look at the relationship between ASVAB scores and training grades.
- Test scores predicted 8 to 22% of variance in recruiter grades.

| Module | $R^2$ ($R^2_{adj}$) |
|---|---|
| 2 | .17 (.16) |
| 3 | .08 (.07) |
| 4 | .20 (.19) |
| Composite | .22 (.22) |

All relationships significant, $p<.05$.

# Results: Recruits per Quarter Criterion

Variables were entered in four steps:

| Step | $R^2$ ($R^2_{adj}$) | Change in $R^2$ ($R^2_{adj}$) |
|---|---|---|
| 1 - Recruiting Stations & Quarters | .16 (.12) | |
| 2 - Rank, Marital Status, Mos. in Military | .22 (.18) | .063 (.062) |
| 3 - ASVAB Scores | .23 (.18) | .013 (.004) |
| 4 - Recruiting Training Grades | .23 (.18) | .001 (-.001) |

All steps significant, $p<.01$.

- Altogether, personal characteristics, test scores, and grades that could be used for selection accounted for 7.7% of variance ( 6.5% adjusted for # of variables).
- Training grades contributed no practical increase in validity, though technically the increment was statistically significant. Without them, adjusted $R^2$ is 6.6%.

# Results: High-Quality Recruits per Quarter Criterion

Variables were again entered in four steps:

| Step | $R^2$ ($R^2_{adj}$) | Change in $R^2$ ($R^2_{adj}$) |
|---|---|---|
| 1 - Recruiting Stations & Quarters | .11 (.07) | |
| 2 - Rank, Marital Status, Mos. in Military | .16 (.12) | .046 (.043) |
| 3 - ASVAB Scores | .17 (.11) | .008 (-.002) |
| 4 - Recruiting Training Grades | .17 (.11) | .002 (-.001) |

All steps significant, $p<.01$.

- Personal characteristics, test scores, and grades accounted for 5.6% of variance (4.3% adjusted for # of variables).
- Again, training grades contributed no practical increase in validity. Without them the personal characteristics and test scores accounted for 5.4% of variance.

# Cost-Effectiveness Model: Development

- The HumRRO-Lewin(H-L) Cost-Effectiveness Model has origins in research in Industrial Psychology and Economics
- It draws on several earlier models:
  - Cost-Performance Tradeoff Model
    [McCloy et al.(1992). *Accession quality job, job performance,and cost*. HumRRO.]
  - Rand Model
    [Fernandez & Garfinkle (1985). *Setting enlistment standards and matching recruits to jobs using job performance criteria*. Rand.]
  - Brogden-Cronbach-Gleser Model
    [Brodgen (1949). When testing pays off. *Personnel Psychology*, 2, 171-183; Cronbach & Gleser (1965). *Psychological tests and personnel decisions*. Univ. of Illinois Press.]
  - Nord & Schmitz Model
    [Nord & Schmitz (1989). Estimating performance and utility effects... In *The economic benefits of predicting job performance*. Institute for Defense Analysis.]

# Cost-Effectiveness Model: Purpose

- Goals in the development of this model were to:
  - Account for recruiter productivity without having to place a dollar value on it
  - Provide ability to estimate value of different recruiter selection methods
  - Provide ability to adjust the probability of achieving the goal above the 50% probability of an "expected value" estimate

# Cost-Effectiveness Model: Purpose

- Purpose of selection: Improve recruiter productivity above that achieved without valid selection.

- The H-L model includes a minimum selection score ("cut score") that corresponds to a minimum level of expected productivity .
  - Goal: Accept only potential recruiters with expected productivity $\geq$ that minimum.
  - Mean productivity for recruiters selected with valid measures ("truncated mean") will be above mean productivity for recruiters assigned without valid measures ("population mean").
    - Truncated mean will exceed population mean

# Cost-Effectiveness Model: Basic Elements

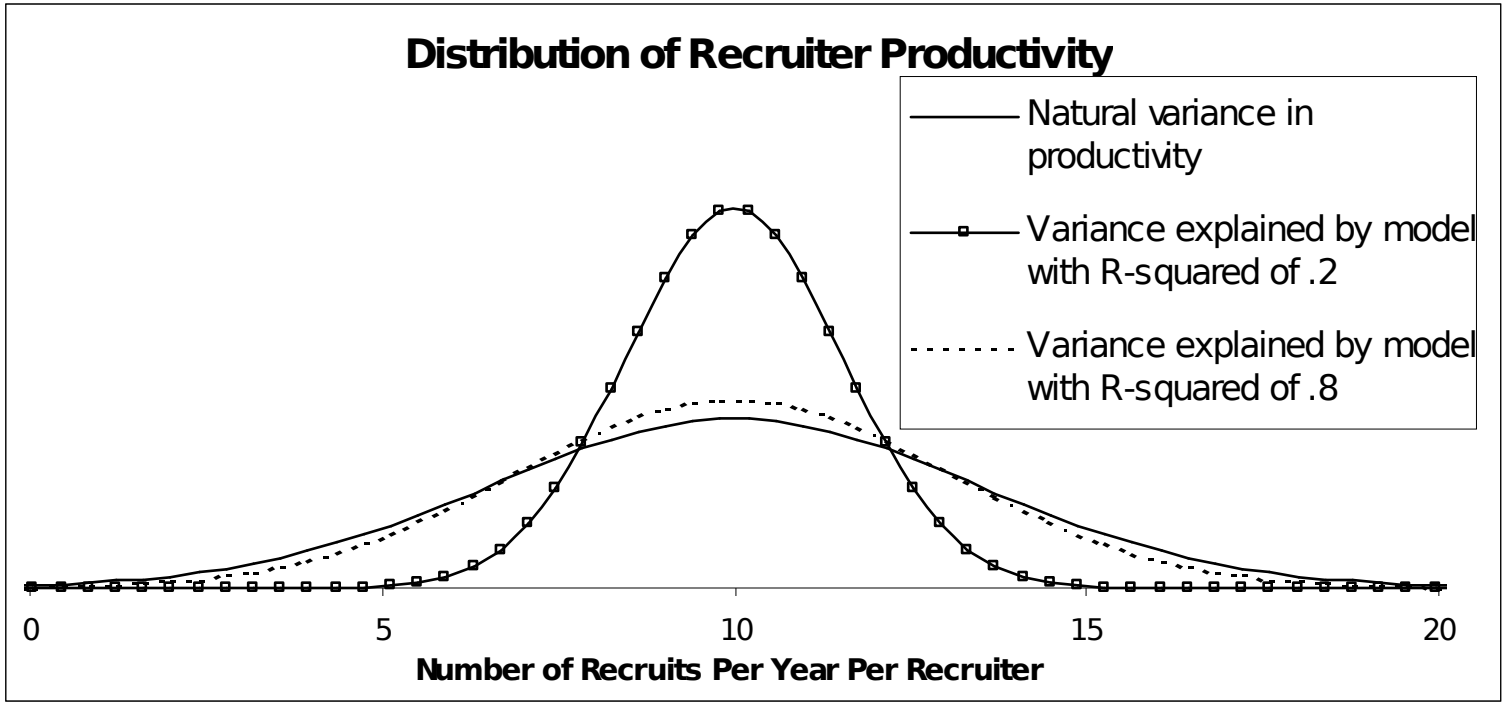
- Benefits:
  - With greater average productivity, fewer recruiters are needed to achieve goal
  - With fewer recruiters, training and employment costs can decrease
- Cost:
  - Will be applying more resources to testing recruiter candidates
    - more applicants must be tested, the higher the cut score
- Model trades reduced costs of fewer recruiters with added cost of testing to obtain net benefit.
  - Selection is cost effective if:

(cost savings from training and staffing fewer recruiters) **>** (added cost of testing)

# Cost-Effectiveness Model: Influences on Outcomes

- Benefits of selection are greater:
  - The greater is the variation in productivity in the population of potential recruiters
    - if there is little variation, no reason for selection
  - The greater is the variation that the selection equation can explain
    - the $R^2$ measures the proportion of total variation in recruiter productivity that can be explained by the selection model
    - the higher the $R^2$ of the selection model, the greater the benefits of selection, other things being equal
  - The greater are the costs of recruiters
  - The lower are the costs of testing and screening

# Cost-Effectiveness Model: Influences on Outcomes



# Cost-Effectiveness Model: Parameters

- H-L Cost-Effectiveness Model accounts for:
  - Total variation in productivity
  - Explained variation, $R^2$
  - Selection cut score (minimum score for selection as a recruiter)
  - Cost of recruiter
  - Cost of testing/screening

- H-L Cost-Effectiveness model is in a spreadsheet format that treats key factors parametrically

# Application of Cost-Effectiveness Model to Recruiter Productivity

- Productivity and goals are specified in terms of high-quality recruits

- To implement the model, the following parameters are specified:

| | | |
|---|---|---|
| Unconditional Mean Productivity | 7.4 | high quality recruits per quarter |
| Unconditional Variance of Productivity | 20 | high quality recruits per quarter |
| Cost of Recruiter | $61,500 | per year |
| Productivity Goal (Number of A-Cell Recruits Desired) | 37,000 | recruits per year |
| Predicted Productivity Cut-off | 7.4 | high quality recruits per year |
| Incremental $R^2$ of Productivity Model | 0.054 | |

Note: Incremental $R^2$ refers to added proportion of explained variability from personal characteristics. These parameters remain constant throughout the remainder of the analysis.

Time period of analysis is quarterly because the selection equation estimates quarterly productivity.

# Application of Cost-Effectiveness Model to Quarterly Recruiter Productivity

- Preliminary results of the model in non-dollar denominated outcomes:

| | |
|---|---|
| Approximate Variance of Predicted Productivity | 1.08 |
| Truncated Mean | 8.23 |
| Number of Recruiters Needed to Assure Goal is Achieved with the Probability Alpha | 4496 |
| Number Needed to Be Tested to Attain Number of Recruiters Needed | 8992 |

# Application of Cost-Effectiveness Model to Annual Recruiter Productivity: Testing Cost Sensitivity

- Testing costs are mainly administrative, but are unknown.
- Various estimates were used to test the effect of testing costs on savings.
- Testing costs of $500, $1,000, and $2,000 were used..

| | Case 1 | Case 2 | Case 3 | Case 4 |
|---|---|---|---|---|
| $R^2$ | .000 | .054 | .054 | .054 |
| Annual Goal (A-Cell) | 37,000 | 37,000 | 37,000 | 37,000 |
| Recruiters Required | 5,000 | 4,496 | 4,496 | 4,496 |
| Number Tested | ------- | 8,992 | 8,992 | 8,992 |
| Unit Cost of Test | N/A | $500 | $1,000 | $2,000 |
| Annual Net Cost | $307.5M | $281.0M | $285.5M | $294.5M |
| Savings | ------ | +26.5M | +22.0M | +13.0 M |

# Application of Cost-Effectiveness Model to Annual Recruiter Productivity: Explanatory Power Sensitivity

- Testing costs are assumed to be $2,000, which is probably a significant overestimate
- Explanatory power for selection varies from 0.05 to 0.01, as measured by $R^2$.
- Only in unlikely "worst case" does selection fail to reduce recruiting costs

| | Case 1 | Case 2 | Case 3 | Case 4 |
|---|---|---|---|---|
| $R^2$ | .000 | .05 | .03 | .01 |
| Annual Goal (A-Cell) | 37,000 | 37,000 | 37,000 | 37,000 |
| Recruiters Required | 5,000 | 4,513 | 4,615 | 4770 |
| Number Tested | ----- | 9,027 | 9,229 | 9,540 |
| Unit Cost of Test | N/A | $2000 | $2,000 | $2,000 |
| Annual Net Cost | $307.5M | $295.6M | $302.2M | $312.4M |
| Savings | ------ | +11.9M | +5.2M | -4.9M M |

# Application of Cost-Effectiveness Model to Annual Recruiter Productivity: Can Better Selection Reduce Recruiter Demand to 3,500?

- Testing costs are assumed to be $2,000, which is probably a significant overestimate.
- Can selection plausibly reduce demand for recruiters to 3,500?
- Yes, through a combination of better selection test and higher selection point.

| | Case 1 | Case 2 | Case 3 | Case 4 |
|---|---|---|---|---|
| $R^2$ | .000 | .78 | .05 | .20 |
| Annual Goal (A-Cell) | 37,000 | 37,000 | 37,000 | 37,000 |
| Recruiters Required | 5,000 | 3,507 | 3,509 | 4770 |
| Number Tested | ------ | 7,013 | 1.6M | 24,791 |
| Productivity Selection point | N/A | 7.4 | 10.25 | 9.55 |
| Mean productivity | 7.4 | 10.55 | 10.55 | 10.55 |
| Savings ($) | ------ | +77.8M | -3.1B | $42.6M |

# Application of Cost-Effectiveness Model to Recruiter Productivity

- Observations - All plausible values seem to suggest using currently available data for selection saves money.
  - As long as it costs $3,445 or less per candidate to use these data for selection, it is cost effective over random selection of recruiters or methods with no validity (r = .00)
  - This relatively high breakeven occurs mainly due to the $R^2$=.05 (equivalent correlation of .23 to account for this amount of variation)
  - With more modest $R^2$ =.01, breakeven cost that makes testing equally as costly as random selection is $1,480

# Cost-Effectiveness Model: Future Analyses

The model parameters may need adjustment:

- We assume an annual model and calculations
  - Analyses could be conducted for transition between current recruiting force and selected recruiting force

- We use several numbers for selection costs for use of current data.
  - This should be the *incremental* cost for using these data - if costs are less, we underestimate savings.
  - The selection cost (both variable and fixed) will likely increase with a higher $R^2$ - this is not in our tables.

# Cost-Effectiveness Model: Future Analyses

- The calculation of savings assumes current method has no validity (r=.00)
  - That is, it assumes that recruiters are a random sample
  - If validity is not .00, we overestimate savings.
  - If current method has some validity, using a *random* set of NT candidates (based the tables) may not yield a candidate w/average productivity=7.4.

- Is $61,500 the full cost of employing a recruiter?
  - Are there other overhead costs (e.g., office space, car, phone) per recruiter?

# Cost-Effectiveness Model: Future Analyses

- Assumes similar economic conditions as during FY 99 - FY 00 period.
  - Higher unemployment, maybe higher recruiter productivity.
- Assumes fewer recruiters would be equally as effective as current.
  - Is there a decrease in # of recruiters that would decrease individual effectiveness?
    - e.g., a single recruiter trying to cover too much physical territory?
    - team production
- How many candidates is the Navy realistically willing to consider for recruiter assignment?
  - Does this limit the number who can be tested?
  - What is effect of testing more than model says are needed?

# Back Up Slides

# Literature Review

- Navy recruiters' jobs have a lot of similarities to sales jobs.

- Both involve:
  - selling skills
  - human relations skills
  - organizing skills

# Literature Review

- Research on the use cognitive aptitude tests for predicting sales performance suggests that tests like the ASVAB may predict recruiter performance:
  - Meta-analysis: cognitive ability the best predictor of job proficiency (for all jobs, not just sales).
    - Mean correlations from .29 to .61.
  - A study on sales people: mean correlation of cognitive ability tests with sales performance was .61.

# Literature Review

- In a study of sales agents: Mean correlations of 4 cognitive abilities (verbal, numerical, reasoning, and perceptual speed/accuracy) predicting sales performance ranged from .15 to .27.

- A review on power of ASVAB cognitive tests, personality tests, and biographical data scales to predict sales performance found correlations of .17 to .29.

# Literature Review

- Performance vs. Productivity: Different variables
  - Cognitive ability best predictor of job performance; predictive of sales performance.
  - Some evidence it is less predictive of sales productivity.
  - Some military recruiting studies have shown poor relationships with productivity
    - Personality/interest measures appear to be better predictors of recruiter productivity
    - Possible reasons
      - Performance/productivity difference
      - Range restriction in military recruiter samples

# Literature Review

- In summary, past research indicates:
  - ASVAB tests may have some ability to predict recruiter productivity.
  - Personality tests designed specifically for selecting recruiters should have greater predictive ability.
- This research explores these issues
  - Phase I focuses on evaluating predictive validity of ASVAB tests and other currently available data
  - Phase II focuses on evaluating predictive validity of personality tests
- The cost-effectiveness model developed in this phase provides the ability to compare the cost-effectiveness of the different selection methods.

# Cost-Effectiveness Model: Varying Parameters